PUBLIC HEALTH GIS NEWS AND INFORMATION

October 1997 (No. 18) ... Third Year Anniversary Edition

Dedicated to CDC/ATSDR scientific excellence and advancement in disease control and prevention using GIS

Selected Contents: Meetings and conferences (p.1); News from GIS Users (pp.1-5); GIS outreach (pp.5-6); Special reports (pp.6-7); Public health GIS literature (pp.7-16); Other news (p.16)

I. Public Health GIS (and related) Events

☞ 1997 International S-PLUS User Conference, October 27-28, 1997, Seattle, WA; contact conference information at www.mathsoft.com/splus/. [See announcement in II.C. below]

☛ GIS/LIS 1997 Annual Conference and Exposition, October 28-30, 1997, Cincinnati, OH; Several presentation abstracts that address public health themes are included in Section V of this newsletter. For the full conference program, see website http://www.cla.sc. edu/gis/gislis 1997/program.html.

☞ XIV Annual International Methodology Symposium, "New Directions in Surveys and Censuses", Statistics Canada, Ottawa, November 5-7, 1997. [For more information see http://www.statcan. ca/english/ symposium97]

☛ 12th International Conference and Workshops on Applied Geologic Remote Sensing, Denver, CO, November 17-19, 1997. [Contact: Robert Rogers, (313) 994-1200 ext. 3234 or e-mail raeder@erim.org]

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10th Annual NCHS Geography Awareness Week celebration with a presentation by Lee De Cola, Research Physical Scientist, U.S. Geological Survey. The talk is entitled "Giving Statistics a Dynamic Life through Map Animation," to be held at NCHS, **November 19, 1997**, 2:00-3:00 P.M., Hyattsville, MD, with Envisioning to offsite locations. An abstract is enclosed in this newsletter. [Contact: Chuck Croner, ORM, NCHS at cmc2@cdc.gov]

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☞ 12th National Conference on Chronic Disease Prevention and Control, "Prevention Opportunities for the 21st Century", Washington, D.C., December 3-5, 1997. [Contact: Kathleen Carey, (770) 488-4239]

☛ 1997 International Conference on Health Policy Research, Methodologic Issues in Health Services and Outcomes Research," American Statistical Association, Crystal City, VA, December 5-7. [For more information see http://www.monmouth. com/~healthpolicy/Decconf. html]

☞ 46th Annual Meeting of the American Society Of Tropical Medicine and Hygiene, Orlando, FL, December 7-11. [Contact: Peter F. Weller at (847) 480-9592]

II. News from GIS USERS

(Please communicate directly with colleagues on any issues)

A. General News (and Training Opportunities)

1. From **Steve Melly**, Silent Spring Institute: I have been recently working on our web site and included some GIS examples from the Cape Study [Cape Cod breast cancer]. It's located at http://www.silentspring. org. [Contact: Steven Melly at melly@silent.shore.net or voice (617) 332-4288 ext. 13]

2. From **Russell Kirby**, UW-Madison Medical School: I'm doing a lot of thinking and writing about data quality generally, and as applied to quality improvement initiatives in health care. Also in December I'll be doing a roundtable presentation at the Maternal Infant and Child Health Epidemiology Program Workshop (CDC/MCHB initiative) on 'From public health to population health: paradigm shift for maternal and child health?' which will definitely have some spatial analysis/GIS content. [Contact: Russ at r-kirby@whin. net or voice (414) 937-5610]

3. From **Pete Thornton**, County Government: Here at the Volusia County Health Department in Florida, we are in the process of incorporating local public and private patient data from all clinics and hospitals as well as a plan to integrate all pharmacy data. This is in addition to the already existing system for environmental health activities. Since we have invested in the central system and the systems in each of 6 outlying offices, we have an interest in what other localities are doing. [Contact: Pete Thornton, Environmental Administrator at ehvolco@aol.com]

4. From **Duane Marble**, Ohio State University: You might be interested in looking at the material by Jennifer Miller on our web page: http://thoth.sbs.ohio-state.edu/ research/papers. She did some interesting work on the spread of raccoon-borne rabies in the mid-Atlantic states and we have reproduced some of her annual county-level maps of the spread of the disease. This has now reached NE Ohio and after the discovery of four rabid bats in the Columbus Zoo there is a fair amount of local sensitivity on the topic. [Contact: Duane F. Marble at marble.1@osu.edu or voice (614) 292-2250]

B. Technical News

5. From **Danika Holms**, Geofields: You are invited to join the south east regional users group for user's of ESRI software at our 1997 training sessions and conference located in Atlanta, Georgia- South East Regional ESRI User Group (SERUG) 1997 Conference, October 22-24 (Training Sessions October 20-21), Atlanta, Georgia. Five concurrent 2 day workshops will be offered this year including ArcView, Avenue, Map Objects, Managing GIS and Spatial Analyst Extension. [Danika, at e-mail dholm@geofields.com or voice (404)875-2550]

6. From **Lois Dean**, HUD (through ppgis-scope@igc.org): The Federal Geographic Data Committee is soliciting public comments on two standards proposals, one to develop an Environmental Hazards Geospatial Data Content Standard and the other to develop a National Shoreline Data Standard. If the proposals are approved, the standards will be developed following the FGDC standards development and approval process and will be considered for adoption by the FGDC. The FGDC invites the community to review the proposals and comment on the objectives, scope, approach, and usability of the proposed standard; identify existing related standards; and indicate their interest in participating in the development of the standard. Comments must be received on or before October 3, 1997. A Shoreline Data Content Standard Workshop will be held November 3-5, 1997 at the NOAA Coastal Services Center, Charleston, SC. The proposals for these standards can be viewed and downloaded from the following URL addresses- Hazards: http://www.fgdc. gov/SWG/sub5_1.html and Shoreline: http://www. fgdc. gov/SWG/sub5_6.html; or, for the complete Federal register Notice http://chartmaker.ncd.noaa. gov/ocs/text/ FEDREG.HTM. Reviewers comments may be sent to the following e-mail addresses: Hazards: gdc-hazards@ www.fgdc.gov and Shoreline: millington.lockwood@ noaa.gov.

7. From **Geoffrey Jacques**, BioMedware: I hesitate to send this in because it reports on the development of commercial products here at BioMedware. I find the research fascinating though, and I think your readers might be interested as well. Over the past year or so we've been developing two softwares for the spatial-statistical analysis of GIS data. Both of these projects are funded by SBIR grants from the National Cancer Institute. GBAS is software for the detection and statistical analysis of geographic boundaries. Such boundaries are zones of rapid change in a variable, and are of fundamental scientific interest in many fields. Boundaries in gene frequencies, for example, can arise when there are barriers to gene flow, and also may represent genetic hybrid zones. In cancer epidemiology, boundaries analysis can be used to define the spatial edges of areas of high cancer mortality. This is of obvious utility when defining a study's geographic sub-populations. Once boundaries are defined, GBAS provides tests for boundary overlap to determine, for example, whether boundaries in health variables coincide with boundaries in

environmental/ exposure variables. We currently are in software verification and testing. GBAS is a 32 bit application and runs under Win95/NT.

Gamma is software for conducting statistical inference from spatial data that are observational and uncertain, characteristics that apply to most health/environment data. It uses location models and spatial Monte Carlo methods to account for (1) location uncertainty, (2) spatial autocorrelation, and (3) a study's spatial sampling space in the statistical inference structure. This results in flexible, spatial randomization tests that have greater statistical power than standard approaches. The software has an imbedded spatial data structure for calculating proximity metrics, and is scalable from desktop to distributed inter/intranet applications. It uses a flexible gamma product form (hence the name) for calculating spatial statistics such as Mantel's, Cuzick and Edward's, Moran's I, Join-count, Knox and many other tests. The software will be completed sometime next year. We are looking for individuals and organizations who would seriously beta-test and apply these products. [Contact: Geoff Jacquez at Jacquez@BioMedware.com]

8. From **Stephanie Hulina**, IDRISI Project, Clark University- Announcing an Upcoming GIS Workbook Addressing Applications for Public Health and Epidemiology: The IDRISI Project, founded in 1987 by Geography Professor Ron Eastman, is a non-profit project within the Graduate School of Geography at Clark University, Worcester, MA. The raster-based geographic analysis packages IDRISI and IDRISI for Windows are developed, distributed and supported by the Project. To date, there are over 20,000 registered users of IDRISI software in over 130 countries, making it the most widely used raster GIS in the world.

In 1990, the IDRISI Project signed a memorandum of understanding with the United Nations Institute for Training and Research (UNITAR) to provide scientific assistance to its training programs through the development of curricula and training materials related to specific application areas (ex. forestry, hazard assessment and management, etc.). Out of this, a workbook series, Explorations in Geographic Information Systems Technology was developed. Six volumes have been completed to date, with the seventh and eighth volumes to be released sometime this fall. The series has been of interest to a wide audience, including resource managers, researchers in each workbook's application area, educators, and those interested in learning more about GIS. As a continuation of the GIS workbook series, volume nine, addressing GIS applications in public health and epidemiology, is currently in development.

The structure of the workbook will be 1) a review paper that explores the use of GIS analytical techniques in the fields of public health and epidemiology, complete with extensive bibliography; and 2) a set of exercises (approximately 6 to 10) that allows the user to apply these techniques to geographically diverse case study problems using real digital data sets and GIS software. For more information on the workbooks (as well as general information on the IDRISI Project), visit the IDRISI Web site at http://www.idrisi.clarku.edu.

This workbook will be a great opportunity to present to a wide audience a unified overview of GIS applications for public health and epidemiology to date. It will also showcase the preeminent work of individual researchers. There will be case-studies, for example, on malaria modeling in Mexico, analyzing the distribution and determinants of Lyme Disease in Maryland, exploring ecological hypotheses for Hantavirus Pulmonary Syndrome in the American Southwest, remote sensing tools for malaria modeling in Southern Africa, and analyzing links between breast cancer and the environment on Cape Cod, just to name a few. This new GIS workbook is scheduled for release early next year. Announcements will be posted at the IDRISI Project Web site. [Contact: Stephanie Hulina at shulina@clarku.edu]

9. I receive many inquiries about desktop GIS mapping softwares. My advice is to both read the reviews and check with other GIS Users who have some experience with their selection. For example, there is a review in the September issue of *PC Computing* that gives ESRI's ArcView 3.0 and Caliper

Corporation's Maptitude 3.0 very good grades but rates MapInfo Professional 4.1 highest. However, I'm not so sure how this holds up with public health applications in mind e.g., spatial analysis and statistical modeling, since the review is oriented toward business desktop GIS. That's why it's good to speak with public health colleagues involved with one or more of these GIS software programs.

A similar case can be made for GPS receivers and GIS attribute data capture. There are many on the market and price and performance vary widely. Data entry capabilities are especially important where attribute data are essential in field operations. For example, characteristics of survey respondent's houses such as age, building material, number of rooms, public or private drinking water, plumbing standards, paint quality, etc., may be attributes you want in the GIS database. Will the GPS allow for unlimited storage for numeric values, character strings, dates and times? Also, there are many other issues to examine such as positional accuracy, data edit and validation functions, and possibly even segment functionality when collecting linear features from a vehicle. Remember: read the reviews but also speak with knowledgeable users. Editor

C. Internet News

10. From Philip Tanimoto, Conservation Imaging, Inc.: For anyone needing information on GIS training by ESRI, you can turn your browser to: http://www.esri. com/base/training/training.html. It provides information courses, schedules, locations, and pretty much everything else you would need. As a second choice, you can contact Desktop Assistance at: http://www. desktop.org.They are a nonprofit, conservation-oriented promoter of GIS technology and offer training. As a third choice, you could visit http://ci. moscow.com , the home page of Conservation Imaging, Inc. Conservation Imaging is also a nonprofit, conservation-oriented promoter of GIS technology, research, training and support.

11. From Advanced Technologies in Ecological Science (eco-tech@umdd.umd.edu): The Food and Agriculture Organization of the UN has recently issued an interesting publication "AFRICOVER Land Cover Classification." This describes a land cover classification system that is being implemented for the continent of Africa focusing primarily, but not exclusively, on vegetation. The document is put out by the Environment and Natural Resources Service, Research, Extension and Training Division, FAO Sustainable Development Department, Via Terme di Caracalla, 00100 Rome, Italy. Price for the 76 page document is unknown (Document D/W4634E/ 1/4.97/600).

12. MathSoft invites you to attend the 1997 International S-PLUS User Conference at the Westin Hotel, in Seattle, WA, October 27-28, 1997. The conference is a forum for S-PLUS users from any industry to exchange ideas on data analysis, visualization and modeling with S-PLUS. Presentations will feature specific user applications and data analysis techniques for pharmaceuticals, finance, semiconductors and other areas. Users from around the globe will attend this conference to learn new techniques and network with other S-PLUS users. Please mark your calendars and join us at the 1997 International S-PLUS User Conference.

13. Environmental Hazards Geospatial Data Content Standard (PUBLIC REVIEW of full standard proposal at http://www.fgdc.gov/SWG/swg.html): The Federal Geographic Data Committee (FGDC) is soliciting public comments on the proposal to develop a "Environmental Hazards Geospatial Data Content Standard." The FGDC invites the community to review the proposal and comment on the objectives, scope, approach, and usability of the proposed standard; identify existing related standards; and indicate their interest in participating in the development of the standard.

OBJECTIVES: To develop a nationally focused Environmental Hazards Geospatial Data Content Standard (hereafter called Environmental Hazards Standard) that will establish a consistent approach to sharing information about natural and manmade substances, materials, and conditions that are, or have the potential to be, detrimental to

ecosystems on the earth. Specific goals of the standard are: 1.To compile common definitions for environmental hazard data that will facilitate the effective, use, understanding, and automation of geospatial information. 2. To standardize entities, attributes, and domain values that will improve the creation, management and data sharing of environmental hazard data. 3. To resolve discrepancies related to the use of similar terms, thereby minimizing duplication within and among systems.

SCOPE: The environmental hazards standard will address data concerning the evaluation and investigation of the existence of environmental hazards, monitoring the presence of hazards, preparedness and protection from hazards, and remediation of their effects. This standard will include the management of information about chemical and biological substances, hazardous materials, and physical conditions that affect the earth's ecosystems, including air, soil, and water systems (both surface water and ground water.) This standard will not address natural disasters (e.g., volcanoes, earthquakes.) DATES: Comments must be received on or before **October 3, 1997**. [Contact: Send comments via Internet to gdc-hazards@www.fgdc.gov; Comments e-mailed as attachments must be in ASCII format]

III. GIS Outreach

(Editor: All solutions are welcome and will appear in the next edition; please note that the use of trade names and commercial sources that may appear in *Public Health GIS News and Information* is for identification only and does not imply endorsement by CDC or ATSDR)

☎ From **Mark Oberle**, INPHO, CDC: Several of us in the INPHO group were discussing the risks of reinventing the wheel that many state agencies might run when they start up GIS operations. We have seen that in several site visits where within the same state agency, staffers are not aware of others' efforts in setting up GIS systems. Are you aware of any interstate effort to share information or lessons learned in GIS systems?

Response from **Rebecca Somers-St. Claire**: Tell Mark Oberle to contact the National States Geographic Information Council (NSGIC) 603-643-1600. Also, the book about the NSDI Framework that I am writing for the FGDC will address some of those issues. It will be available from the FGDC secretariat later this fall. [Rebecca has a GIS consulting company and can be reached at e-mail SStCl@aol.com]

Response from **Carol Hanchette**, North Carolina state government: In mid-August, the Robert Wood Johnson Foundation held a 2-day workshop in Columbia, SC entitled "Mapping for Policy." One of my staff members attended. To my knowledge, this workshop was held for RWJ grantees only, but it provided for an exchange among GIS/public health personnel in several states.

Response from **Jon Sperling**, Census Bureau: This note refers more to sharing geographic information rather than starting up GIS systems. During the past year, we (the Census Bureau) have been heavily involved in reviewing, editing, and converting local and state government GIS files to a standard format for updating the TIGER data base. So far, we have processed over 50 files and we are processing more all the time. The process currently only looks at and processes base geographic data such as street centerlines, streets names, address ranges and ZIP Codes (no coordinate enhancement to TIGER yet). This work reduces duplication of effort and costs (reinventing the wheel) and has a number of other benefits. Of course, we would all benefit if there was more state coordination of all these local files (and some states are doing this). Local GIS files vary significantly from place to place and contain different types of data (e.g. turn restrictions, speed limits, etc.). It is quite obvious which counties are more sophisticated and which are just starting out.

The process is still not fully formalized, but we are providing feedback to local or state representatives providing files and reviewing whether they follow certain standards or maintain documentation (metadata). I have a paper on the ESRI home page (1997 ESRI User Conference on Updating TIGER with NonCensus Spatial Databases) that may be of interest (and a brief article in “Public Health GIS News and Information”). Currently, I am working with

several state and local agencies concerning the use of their GIS files to update TIGER. Having worked with a wide variety of files from across the country, I hope to work on some further documentation on standards; that will help reduce the amount of editing we need to do to enhance the quality of these files and maximize geocoding benefits. Many of your comments are addressed in the book by Onsrud and Rushton (Sharing Geographic Information, Rutgers U. Press, 1995 (written in 1992). Much has changed and much has stayed the same. There is more and more activity going on at various levels to address the situations you have mentioned. I see Rebecca Somers is also on this list and I'm sure she has much to contribute on this topic. [Jon can be reached at e-mail jsperlin@ info.census.gov]

☎ From Lisel O'Dwyer, Flinders University (forwarded from **Mary E. Brown**, NIOSH): Does anyone have any experience or knowledge of the use of GIS to model risk of elevated blood lead levels in urban areas? I am proposing to use a Geographic Information System (GIS) to overlay coverages of age of dwellings and material of walls as a proxy for the risk of leaded paint, as well as coverages of soil lead levels (to be obtained by taking samples in the field), traffic flows and wind strength and direction. There is a possibility of obtaining data from a recent national survey of blood lead levels in children but the number of cases would only be approx. 100. There are two main aims: to demonstrate the potential of GIS for in public and environmental health research; and to develop a model for calculating risk of elevated blood lead levels. Although in general I have had good responses to the proposal, the main criticism is that soil lead is not a good indicator of blood lead and thus the outcomes would be of limited use, also that even though there may be high soil lead levels around a dwelling, this does not constitute any risk if no children reside in that dwelling. I would be interested to hear anyone's opinions. Please e-mail me if you would like further detail. Thanks in advance! Lisel O'Dwyer, National Key Centre for Social Applications of GIS, School of Geography, Population and Environmental Management, Flinders University, GPO Box 2100, Adelaide, South Australia 5001, Voice 61 08 8201 2969 and Fax 61 08 8201 3521.

IV. Special Reports

(Submissions are open to all)

❖ From **Steve Scott**, Dakota County Environmental Management Department, Minnesota: I have been working with ArcView for about three years. During that time we have developed a number of themes which we have applied to public health issues. Below is a brief synopsis of some of the projects we're working on.

Dump Site Inventory- Over the past three years we have undertaken the identification and evaluation of all known and suspected areas of disposal in the county. We rely on the use of a variety of data sources including regulatory files, historical aerial photographs, historical land-use maps (Sanborn, etc.) and anecdotal accounts. Recently, we have gained access to photogrammetry hardware and software and have digitized historical aerial photos for interpretation. Data regarding apparent land-use (above ground storage tanks, haul road, disruptions, ground clutter etc. is collected. The location, size and depth of pits and depressions are also collected for comparison to current elevations. This information allows us to better define the areas of known or suspected disposal. Each site is mapped and attribute data identifying the primary type of disposal is listed. These sites are visited by department staff for the purposes of verifying the location and extent of the suspected disposal, to further type the dump contents, to assess cover systems and site access, and to evaluate the current land-use of the site and adjacent properties. Many of these dump areas have been inactive for 30 years or more and so staff relies on secondary characteristics to determine the extent of the disposal. Characteristics of the vegetation (species, type, approx. age etc.) are used to date the age of last disruption. The presence of stressed vegetation is also noted. The topography is assessed and pits, depressions, mounds and "unnatural " slopes and contour break lines are noted. A magnetic locator is used to detect the presence of buried ferrous materials. Also noted are exposed waste and debris, stained soils

and structures associated with industrial usage such as tank saddles, lagoons, fill pipes and vents. To date we have mapped and visited 1,350 disposal sites.

This theme is then used for a variety of analyses. We use this in conjunction with a wells coverage to determine proximity to water supply wells. In limited areas we have mapped ground water quality data in the vicinity to disposal areas. Recently we have been conducting ground water receptor surveys of wells adjacent to dump sites. In several cases we have detected contaminants in drinking water wells which exceed State Health Risk Limits (HRLs). Since knowledge and information regarding these sites is often limited, we have relied on a number of other themes to evaluate our at risk population and exposure pathways. We use the assessor's data regarding ownership to determine the number of residences within a given distance to the site. In addition, at-risk populations associated with land usage such as daycare centers, nursing homes, parks etc are also related spatially with the disposal sites.

As previously mentioned, well locations are presented to determine at-risk populations for ground water exposure. This data however, is incomplete. We have approximated this information by plotting all the residences outside of Municipal Utility Service Areas (MUSA). In this fashion we are able to determine likely locations of drinking water wells. Analysis of the geologic atlas allows us to determine the residences down-gradient from the dump areas. The geologic atlas is also used to provide information regarding areas of the county where the ground water resources are considered sensitive to contamination due to shallow depth of bedrock, bedrock fractures and faults, poor soil cover etc.

Other areas where we are currently using GIS is in lead poisoning prevention and targeting screening. Themes used in this analysis include age of housing, characteristics of the water supply (surface vs groundwater), Location of current and past lead emissions (county is home to a large secondary lead smelter) Presence and location of lead disposal sites. Presence and location of superstructures possibly coated with lead based paints (transmission towers, water towers, and bridges). We have also mapped blood lead levels obtained from a recent study of children in the hopes of seeing a relationship with the other features noted. The ultimate hope is to provide these lead risk analysis to physicians to assist them in determining need to screen. This would augment the use of questionnaires and provide essential information regarding environmental lead exposure that the patient or parent may not be know. This information would be accessible via the internet. We have set up a web site but need further organization with clinics to help test the model.

I have also been using GIS to assist in the development of a LaCrosse encephalitis prevention program. Data regarding woodlot location is collected from aerial photography. Mosquito data is obtained from Mosquito Control district and locations of Aedes triseriatus adults and larva are mapped. Residents within these areas are considered to be at higher risk for LaCrosse encephalitis and appropriate information is targeted to these neighborhoods.. Case sites are also mapped and detections of the vector within these areas prompt additional adult control measures and education efforts.

We have not made any contacts with CDC or ATSDR staff regarding GIS applications; however, I'm aware of the interests of these groups in developing GIS projects which may serve to better identify areas or populations at risk. I have a copy of the Draft document "Screening Young Children for Lead Poisoning" put out by the CDC and I'm interested to see GIS suggested as a method of achieving targeted screening. As I indicated in my last note, this county is home to a fairly large secondary lead smelter. As a result, we have a disposal history which includes a significant number of sites that include lead-acid battery chips and lead smelter slag. We have seen cases of childhood lead poisoning where the suspected source was not the typical ones (old housing stock, etc.) thus the interest in developing a theme which would help identify the potential sources unique to this area.

One of the significant sources of lead poisoning in the county may be associated with the use of lead-acid battery chips as aggregate in individual sewage treatment systems, fill and aggregate. Up until

the 1980s one or two ISTS installers used battery chips as aggregate in the drain field and around seepage pits. As these systems eventually fail or the chips "float" to the surface, lead contaminated battery casings become exposed at the ground surface. Surface scrapings of these chips have contained >200,000 mg/kg lead.

I hope that we can partner with the State Department of Health, CDC, health care provider network or others to help develop and refine this model and to design a study to test its assumptions. I would be interested in GIS Users thoughts regarding this approach. [Contact Steve Scott at e-mail ssas4@wsc. co.dakota.mn.us or voice (612) 891-7537]

V. Public Health GIS Literature

(This section may include literature citations, abstracts, syntheses, etc., and submissions are open to all)

ESRI Users Conference (Selected Abstracts), San Diego, July 1997

Fred L. Clark, Robert E. Klein, Frank O. Richards Jr., Michael Richards, and Sergio G. García, "Application of a GIS in the Control of River Blindness." Abstract: To measure the magnitude and trend of a vector borne disease, onchocerciasis or River Blindness which can lead to blindness, poses a current challenge to a regional public health initiative in six Latin American countries. The disease is endemic in inaccessible regions of tropical America including the Amazon Basin. GIS Solution: The Regional Mapping Center seated at the Universidad del Valle de Guatemala, through support of the Onchocerciasis Elimination Program for the Americas (OEPA), has implemented a GIS to identify suspect communities, program the delivery of medication, measure performance of health workers, and determine impact of treatment. Methodology: The GIS began with digitizing available maps of the endemic zones, identifying suspect and endemic communities using buffer zones of known vector breeding sites, locating communities with the help of GPS units, producing maps to measure the performance of health brigades in the delivery of medication at the community level, and measuring the endemicity and trend of the disease. This experience and technology have been transferred to the six countries where river blindness is endemic through the training of key personnel, field work, georeferencing of communities, and giving them digital maps, software, and equipment. Software: The GIS tool used at the Regional Mapping Center and the endemic countries is Atlas GIS Version 3.0 for Windows, databases are in Xbase format, and applications for gathering and keeping data are written in FoxPro and EpiInfo. The purpose of the paper is to show that GIS is a powerful tool for managing and modeling public health problems in developing countries where digital maps are almost nonexistent, access is difficult and funds are scare. The Onchocerciasis Elimination Program for the Americas is a non-for-profit joint initiative of the Global 2000 River Blindness Program of the Carter Center, the Pan American Health Organization and Ministries of Health of the six countries where onchocerciasis is endemic. With partial funding from a grant from the Inter American Development Bank, OEPA founded the Regional Mapping Center at Universidad del Valle de Guatemala in Guatemala City, Guatemala. [F. Clark at Onchocerciasis Elimination Program for the Americas, fclark@ hotmail.com or voice 011-502-366-6106 to 09]

J. Scott Harris (Division of Public Health, Atlanta, GA), "Evaluating Possible Human Exposure Pathways to Populations Relative to Hazardous Materials Sites." Abstract: Defining human exposure pathways is an important and often difficult task involved in the process of assessing risk to public health from hazardous material releases. This process is generally termed a public health assessment (PHA) and combines a number of steps to define the risk posed to susceptible populations. As an indispensable step in the PHA, the evaluation of the exposure pathways is the process of determining the relationship between hazardous material releases and adverse effects on public health. Human exposure pathways are complex systems which are constantly changing in terms of their spatial and temporal presence in the environment. When examining these human exposure pathways, the risk assessor must combine several sources of

information to predict possible routes by which a contaminant could impact public health. Due to the extensive amount of geographic and demographic data which is required to effectively evaluate these pathways, geographic information systems (GIS) are often utilized in the effort. The extent of data available to the public health professional following a release of a contaminant to the environment is directly related to the accuracy with which one can predict exposure pathways. Ideally this process would be done quickly and in the field at the time of a reported release and the routes could be displayed in manner that the probable human exposure pathways are easily shown to pertinent individuals. This paper describes a relatively simple methodology utilizing GIS to predict human exposure pathways in a time-efficient and accurate manner. ArcView GIS 3.0, used in concert with required data sets and other software, provides the health professional with a powerful tool to accomplish this end. [Contact: jsh0600@ph.dhr.state.ga.us or voice (404) 657-0601]

Jon Sperling (US Census Bureau), "Updating TIGER with Non-Census Spatial Databases." Abstract: This paper examines recent developments and strategies to update TIGER with spatial databases maintained outside the Census Bureau. Since the early 1990s, Census Bureau geographers and programmers have been researching, developing, and refining automated tools and methodologies to transfer data from external spatial databases to TIGER. Recent and successful automated and interactive updates from a variety of local geographic information system (GIS) files provide a broad brush outline of existing capabilities as well as a framework for future developments. While the process has not led to a "black box" solution, these initial capabilities offer the Census Bureau a major opportunity to reduce maintenance costs, improve quality, and create more effective partnerships with the public, private, and academic communities. This paper will discuss recent case studies of successful digital exchanges using ARC/INFO files, tools, and software. [Contact: J. Sperling at jsperlin@census.gov or voice (301) 457-1100]

Eleazer D. Hunt and Ezra B. W. Zubrow, "Building Crime Analysis Extensions for ArcView." Abstract: The use of GIS with its ability to visualize spatial relationships, facilitates crime analysis, allowing law enforcement agencies to analyze incident data in exciting new ways. This paper describes the construction of a crime analysis extension kit for ArcView that goes beyond simple map displays and "electronic pin maps"; rather, it can provide predictive modeling and contains algorithms to enhance proactive policing. Funded by a Department of Justice grant, a consortium to build the extension kit was developed, partnering Environmental Systems Research Institute, Inc. (ESRI); the National Center for Geographic Information Analysis at the State University of New York at Buffalo; the City of Salinas, Ca, Police Department; the City of Los Angeles Police Department Crime Analysis Unit; and the San Bernardino County Sheriff's Department Crime Analysis Unit. The police departments will assist in the technical design and needs assessment of the crime analysis tools. The NCGIA will research and build the models, algorithms, and statistical measures for each tool. ESRI will assemble the application. The crime analysis application will be a stand-alone set of tools that will be installed and operated with ESRI's popular desktop GIS software ArcView. The approach is to build upon existing technology and extend it to law enforcement agencies. The application will facilitate the access to police databases with the aid of a "data browser." The data browser allows each department to identify the data tables and map data and let the browser build the links to the crime analysis application. The paper will discuss the status of the project, initial research findings, and anticipated capabilities. [Contact: E. Hunt, ESRI, at lhunt@esri.com]

Robert A. Chastain Jr. (North Carolina State Center for Health Statistics), "GIS Methods for Developing an Exposure Metric for Electromagnetic Fields in Cancer Studies." Abstract: A complex exposure metric for electromagnetic fields (EMFs) which involves the spatial relationship between residences, linear high voltage power line features, and geomagnetic fields is

developed using a GIS. This investigation requires the capture and derivation of an array of physical variables from different data sources. The storage, conversion between formats, and identification and rectification of error in these data are important challenges to meet when designing appropriate methodologies to perform research of this nature. GIS Solution: A GIS is used to 1) locate (geocode) an epidemiological sample of brain cancer cases and controls and produce a digital map layer of high voltage power lines; and 2) capture, derive, and combine a number of data sources needed to apply a physical model that incorporates total geomagnetic field (GMF) intensity, dip angle, the angle of residences relative to nearby power lines, and the orientation of power lines relative to magnetic north into the calculation of an exposure metric which is referred to as the parallel component of the total geomagnetic field. The calculation of this exposure metric may be used to identify potential risk levels at the geographic locations of individual residences within an epidemiological sample within a GIS environment. Various techniques are employed to identify and control error introduction among the input digital map layers. Application or Methodology: Whereas the primary component measured in many power line epidemiological studies has been AC electrical and/or magnetic field intensity, this study involves the derivation and measurement of a more complex exposure metric linked to a parallel component of the GMF surrounding power lines so that its relevance to the spatial distribution of brain cancer may be tested. A major advantage afforded by the use of GIS in the application of this metric to study the possible etiologic role of EMF exposure is the fact that residential access is not required to collect the necessary data at each site. Also, the computational strength of a GIS makes it feasible to study large samples of recorded brain cancer cases where appropriate epidemiological data is available. [Contact: R. Chastain at rchastai@gis.sches.ehnr.state.nc.us or voice (919) 715-4473]

Sarra A. Nanou (Loma Linda, CA), "GIS Role in Public Health." Abstract: GIS methodology is used in this project to find a feasible plan to solve a public health tragedy growing worse day by day. Unwed teenage mothers are not getting proper pre-natal care in the County of San Bernardino. This was resulting in a large increase in babies being born with birth defects. The monumental expenses of caring for these babies was surpassed only by the human suffering of these children and there care givers. The task for GIS would fully tax it's capabilities. GIS must pinpoint the area where this care was needed in a county with an area of 19,319 square miles, populated by only 1,591,000 people. This solution must provide that care, financed by extremely limited income from so few people, and cover an area larger than some of our states. GIS would not only perform the task assigned to it, GIS would point to the solution, and provide the presenter of that solution with the tools to attain the funding required. This should firmly entrench GIS as a prominent and permanent part of problem solving in the field of Public Health. [Contact: S. Nanou at Sarra@elender.com or voice (909) 796-1195]

Allen W. Hightower, Maurice Ombok, Richard Otieno, Richard Odhiambo, Aggrey J. Oloo, Altaf A. Lal, Bernard L. Nahlen, and William A. Hawley , "A Geographic Information System Applied to a Malaria Field Study in Western Kenya." Abstract: This paper describes use of the global positioning system (GPS) in differential mode (DGPS) to obtain highly accurate longitudes, latitudes, and altitudes of 7,209 houses, 65 schools, 110 churches, 9 health care centers, 70 major mosquito breeding sites, 7 shopping areas, major roads, streams, the shore of Lake Victoria, and other geographic features of interest associated with longitudinal studies of malaria in 76 villages in western Kenya. The area mapped encompassed approximately 192 square km and included 42.0 km of roads, 54.3 km of streams, and 15.0 km of lake shore. Location data were entered into a geographic information system for map production and linkage with various databases for spatial analyses. Spatial analyses using parasitologic and entomologic data are presented as examples. Background information on DGPS is presented along with estimates of effort and expense to produce the map information. Information on a second project covering an area larger than 200

square kilometers, where over 7,000 compounds have been mapped to date using a GPS base station with carrier-phase differential processing, will also be presented. Software: Atlas GIS, SAS, FoxPro, AutoCAD. [Contact: A. Hightower at the Centers for Disease Control and Prevention at awhl@cdc.gov or voice (770) 488-7731]

Ronald Fischbach and Elio Spinello, "Using GIS to Analyze Geographic Patterns of Acute Myocardial Infarction in Los Angeles County." Abstract: Target populations for preventative cardiology efforts can be identified geographically by understanding areas of highest incidence with respect to socio-economic characteristics, physician office locations, hospital and emergency room access, and morbidity and mortality rates. Using Atlas GIS and Arc View GIS, a comprehensive analysis of hospital discharges, death certificates, and medical facilities was performed for Los Angeles County. This study evaluates the morbidity and mortality rates of acute myocardial infarctions (MI) by combining hospital discharge data together with death certificate data for the same time period and geographic region. Concentrations of MIs are analyzed with respect to location, proximity to health care providers, public transportation routes, socio-economic and demographic characteristics. Based upon the above findings a prescriptive and narrowly targeted health education program addressing the issues of awareness of symptomatology and appropriate emergency response can be designed and implemented with the objective of reducing the incidence of MIs. The study was completed utilizing Atlas GIS version 3.03, ArcView GIS version 3.0, SPSS for Windows, and Visual Foxpro. [Contact: R. Fischbach, California State University, Northridge, at ronald.fischbach@csun.edu or voice (818) 677-3104]

GIS/LIS '97: Annual Conference and Exposition Presentations (Selected Abstracts), October, 1997

Panelists William Davenhall (Davenhall Associates), William Henriques (GIS Coordinator, ATSDR), Russell S. Kirby (Associate Professor of Clinical Obstetrics and Gynecology and Research Coordinator, UW Medical School) and Gerard Rushton (Professor of Geography, The University of Iowa), "GIS and Health Geographics: Trends, Issues and a Search for Common Ground." Abstract: Over the past five years, GIS and automated mapping have emerged as important tools to support work in improving public health, health care delivery, and environmental health. This interest has been reflected in a number of important ways. Several conferences have focused on the application of GIS in studying the distribution of diseases, visualization of spatial patterns of disease, and the assessment of environmental health risks. In addition, an increased demand in learning about GIS among practitioners in public and environmental health has led to numerous workshops sponsored by such organizations as the Centers for Disease Control and Prevention, the National Environmental Health Association, and various state and local agencies.

This panel discussion considers the important developments in using GIS in health-related applications. The panelists are from diverse backgrounds, including public health, environmental health, business geographics, and academia. They will each provide a perspective on the trends, progress and roadblocks to a fuller utilization of GIS in health geographics. Which areas are best developed? What are important hardware, software and data issues? Where is the common ground among academic institutions, public health workers, health related businesses and those who emphasize environmental health? What are the educational needs of people entering this field? What are important areas of research? This interdisciplinary panel will bring together ideas and expertise to address these questions. [Contact: Marilyn Ruiz, Organizer and Chair, Florida State University at mruiz@coss.fsu.edu or voice 904-644-8374]

Jayajit Chakraborty and Marc P. Armstrong (Department of Geography, The University of Iowa), "Assessing the Impact of Segregation on Environmental Equity Using GIS." Abstract: A considerable amount of empirical research, conducted during the last decade, has attempted to determine whether racial minorities and the economically disadvantaged are disproportionately located in

neighborhoods containing environmental hazards. A common approach is to estimate and compare the characteristics of populations in geographic areas that contain environmental hazards with populations in other similar units that do not contain such hazards. This approach is not entirely satisfactory, however, since it ignores the constraint posed by the intra-urban spatial arrangement of various racial and income groups. Given the existence of residential segregation, or the tendency of low-income minorities and high-income whites to be concentrated in different areas within a city, the locations of toxic facilities are likely to produce a disproportionate impact on one of the two groups, in terms of proximity to these sites. The objective of this research is to examine the effect of segregation on GIS-based analyses of environmental equity that are conducted at different geographic scales. We specifically focus on income segregation and measure income inequities in the distribution of industrial toxic emission locations. The association between a commonly used measure of segregation: the dissimilarity index, with an aggregate GIS-based measure of environmental equity is examined for a set of 30 urban counties. Our findings indicate that there is a moderately strong association between the measures of segregation and equity at both the census tract and block group levels of aggregation. The extent of environmental inequity is greatest in those counties that are highly segregated on the basis of income. [Contact: E-mail at email jayajit-chakraborty@uiowa.edu or marc-armstrong@uiowa.edu or voice (319) 335-0153]

Gregory A. Elmes, Luc Anselin, Joel Halverson, Jong Yoel Lee, Sara Loftus, and Elizabeth Barnett (Department of Geology and Geography, Regional Research Institute, and Prevention Research Center, West Virginia University): "Spatial Partitioning Methods for Small Area Analysis of Cardiovascular Disease." Abstract: Epidemiological research has consistently encountered problems in the specification of appropriate geographic units for analysis of disease distributions as an essential step in the identification of excess mortality and morbidity in small areas. The underlying modifiable areal unit problem (MAUP) can inject spatial patterns where none exist or mask real ones. Additionally the question of appropriate spatial partitioning is confounded by heterogeneous population and disease incidence distributions, whereby small numbers introduce high levels of uncertainty into rate calculations. Stratifying populations by race, age and sex accentuates the problem. Previous studies have invoked aspatial schemes (e.g. metro/non-metro, urban/rural), or have relied on spatial and temporal aggregation to reduce variance due to random effects and have chosen areal units (e.g. state, labor market area) which remain consistent across the study region.

We present a heuristic, written in Arc Macro Language (AML), for the generation of areal units from heterogeneous underlying distributions. Decision rules from regional theory and exploratory spatial data analysis (ESDA) are combined to define areal units suitable for investigations into potential risk factors for cardiovascular disease in Appalachia. The method incorporates demographic patterns, rurality, economic activity and constraints on geometric form. In principle, areal units should reflect the scale, structure and nature of the socio-economic processes being investigated and the ability to integrate multiple datasets of varying spatial resolution is necessary. Data inputs include 1990 Census, TIGERline, Public Use Microdata Samples (PUMS), Area Resource File, and CDC mortality data. ESDA techniques then allow for the visualization of realizations of the regionalization method. Keywords: Epidemiology, area-specific rates, small area analysis, regionalization method. [Contact: All authors at West Virginia University, Morgantown WV 26506]

Daniel Haug, Alan M. MacEachren (Department of Geography & Population Research Institute), Frank Boscoe, David Brown, Colin Polsky, Mark Marrara (Department of Psychology), and Jaishree Beedasy, "Implementing Exploratory Spatial Data Analysis Methods for Multivariate Health Statistics." Abstract: This paper reports on the development of prototype software designed for exploratory visualization of geographically referenced health statistics. The software prototype provides a number of interactive

methods for statistically exploring relationships between risk factors and mortality rates and how they are distributed in space. The use of geographically referenced mortality data to detect disease "hot spots" can be traced at least to Dr. John Snow's 1854 map of cholera deaths in London, which allowed him to hypothesize that a particular water pump was the source of the epidemic. While the use of traditional static maps for cluster identification continues to be important, with a major new atlas of mortality in the U.S. just published, dynamic exploratory data analysis and visualization techniques have the potential to further enhance detection of "hot spots". Our prototype implements a number of exploratory data visualization techniques within existing geographic information systems software (ArcView, ESRI, Redlands, CA). These techniques, including scatterplot brushing, interactive data classification, focusing, and representation methods for multivariate display, can help the analyst identify disease hot spots and facilitate data exploration that may lead to hypotheses about causal links between mortality and potential risk factors. This paper will discuss the technical issues surrounding the implementation of these visualization techniques and the ways in which these techniques may be employed in existing GIS software. Finally it will examine possible enhancements to the methods as implemented here. [Contact: Lead author at e-mail dbh134@psu.edu; affiliation of coauthors Penn State University and Department of Geography where not shown above]

Steven C. Zuckerman (US Bureau of the Census, Geography Division), "Visualization of Census Data: A cooperative research and development agreement (CRADA) between the Census Bureau and Environmental Systems Research Institute, Inc." Abstract: In March of 1997 the Census Bureau entered into a Cooperative Research and Development Agreement (CRADA) with Environmental Systems Research Institute, Inc (ESRI). The goal of the CRADA is to investigate new technologies that will enable the Census Bureau to update its digital map database (TIGER) and develop new products to enhance the display of its socioeconomic data on maps. This paper will focus on the new product component of the CRADA which will combine quality statistical and spatial data from the Census Bureau with the spatial technology and human interface systems of ESRI. The resulting product will serve the public by providing an effective and inexpensive way to access and visualize Census data and promote the Census 2000. The CRADA agreement identifies several topics for the research and development process, which include the selection of appropriate statistical data, determination of geographic levels of presentation, defininition of the graphic and analysis functionality of the software, application design, and the implementation of an effective development and marketing program. Addressing these topics, developing an appropriate product design model, and delineating resources require close collaboration by both parties. This paper will report on the status of the product development portion of the CRADA as well as the unique issues that are raised in a public/private cooperative effort. [Contact: E-mail szucker@census.gov or voice (301) 457-1101]

Robert B. McMaster, Helga Leitner and Eric Sheppard (Department of Geography, University of Minnesota), "A Multiscale Approach For Assessing Environmental Risk." This research project details the utilization of geographic information systems to assess environmental risk in the Twin Cities area of Minnesota. Stage one of the project has completed a risk assessment using multiple sources of hazardous substances, including Toxic Release Inventory (TRI), Petrofund, Superfund, and Land Recycling data and 1990 U.S. census data at multiple resolutions (MCD, tract, block-group, and block). Additionally, a variety of institutional data were geocoded for the study, including all day care centers, schools, community centers, and retirement homes for the City of Minneapolis. In particular, we present the hazards landscape as related to two geodemographic variables-- concentrated poverty and percent minority population. Stage 2 of the project involves revising the analysis to more accurately account for the actual risk around TRI sites using simple buffers, toxicity indices, and a plume dispersion model. The risk

landscape, originally determined by simple existence of a site in Stage 1, changes considerably as more sophisticated methods are used within the GIS. We compare and contrast each of the methods, and make recommendations as to optimal approaches for risk assessment, including the effect of resolution. The end result of this study will be the development of a comprehensive risk model for the Twin Cities, a spatial analysis of sensitive and minority populations related to this risk, and an attempt to articulate the degree of environmental injustice that results from the storage and manufacture of hazardous materials. [Contact: E-mail mcmaster@atlas.socsci.umn.edu or voice (612) 625- 9883]

10th Annual NCHS Geography Awareness Week Lecture Series: November 1997

De Cola, Lee, "Giving Statistics a Dynamic Life through Map Animation," NCHS Auditorium, November 19, 1997, 2:00-3:00 P.M., Hyattsville, MD. Envision arrangements can be made at your offsite CDC/ATSDR location. Abstract: Researchers at the U.S. Geological Survey have used historical maps and digital data for a 168- by 220-km area of the Baltimore-Washington region to produce a dynamic database that shows growth of the transportation system and built-up area between 1792 and 1992. I have developed a Mathematica package that spatially generalizes and temporally interpolates these data to produce a smoothly varying urban intensity surface showing important features of the 200-year urban process. Spatial and temporal interpolation was used to predict urban intensity for 10-year periods from 1800 to 1990, which were animated as a surface and as an isopleth (contour) map. The results were offered on the WorldWideWeb (see Net Site of Interest in this edition of the newsletter) using graphics animation software. This technique can be used to experiment with future growth scenarios for the region, to map other kinds of environmental change, and to visualize such other spatial processes as demographic change and the spread of disease. [Lectures at NCHS are open to all persons. If you have any questions about attendance, please contact Charles Croner, Coordinator, NCHS Cartography and GIS Guest Lecture Series at (301) 436-7904, ext. 146 or e-mail cmc2@cdc.gov]

Recent GIS and Public Health Publications (Selected)

Walsh SJ, Page PH, Gesler WM (1997). "Normative models and healthcare planning: network-based simulations within a geographic information system environment," Health Serv Res Jun;32(2):243-260. OBJECTIVES: Network analysis to integrate patient, transportation and hospital characteristics for healthcare planning in order to assess the role of geographic information systems (GIS). A normative model of base-level responses of patient flows to hospitals, based on estimated travel times, was developed for this purpose. DATA SOURCES/STUDY SETTING: A GIS database developed to include patient discharge data, locations of hospitals, US TIGER/Line files of the transportation network, enhanced address-range data, and U.S. Census variables. The study area included a 16-county region centered on the city of Charlotte and Mecklenburg County, North Carolina, and contained 25 hospitals serving nearly 2 million people over a geographic area of nearly 9,000 square miles. STUDY DESIGN: Normative models as a tool for healthcare planning were derived through a spatial Network analysis and a distance optimization model that was implemented within a GIS. Scenarios were developed and tested that involved patient discharge data geocoded to the five-digit zip code, hospital locations geocoded to their individual addresses, and a transportation network of varying road types and corresponding estimated travel speeds to examine both patient discharge levels and a doubling of discharge levels associated with total discharges and DRG 391 (Normal Newborns). The Network analysis used location/allocation modeling to optimize for travel time and integrated measures of supply, demand, and impedance. DATA COLLECTION/EXTRACTION METHODS: Patient discharge data from the North Carolina Medical Database Commission, address-ranges from the North Carolina Institute for Transportation Research and Education, and U.S. Census TIGER/Line files were entered-into the

ARC/INFO GIS software system for analysis. A relational database structure was used to organize the information and to link spatial features to their attributes. PRINCIPAL FINDINGS: Advances in healthcare planning can be achieved by examining baseline responses of patient flows to distance optimization simulations and healthcare scenarios conducted within a spatial context that uses a normative model to integrate characteristics of population, patients, hospitals, and transportation networks. Model runs for the defined scenarios indicated that a doubling of the 1991 patient discharge levels resulted in an areal constriction of the service areas to those zip codes immediately adjacent to the hospitals, thereby leaving substantial areas unassigned to hospitals during the allocation process, but that doubling the demand for obstetrics care (DRG 391) resulted in little change in the pattern of accessibility to care as indicated by the size, orientation, and pattern of the service areas. CONCLUSIONS: The GIS-Network system supported "what if" simulations, portrayed service areas within a spatial context, integrated disparate data in the execution of the location/allocation model, and used estimated travel time along a transportation network instead of Euclidean distance for calculating accessibility. The results of the simulations suggest that the GIS-Network system is an effective approach for exploring a variety of healthcare scenarios where changes in the supply, demand, and impedance variables can be examined within a spatial context and where variations in system trajectories can be simulated and observed. [Author contact: Department of Geography, Sheps Center for Health Services Research, University of North Carolina, Chapel Hill 27599-3220]

Kitron U, Kazmierczak JJ (1997). "Spatial analysis of the distribution of Lyme disease in Wisconsin," Am J Epidemiol, Mar 15;145(6):558-566. Abstract: Surveillance measures for human cases of Lyme disease in Wisconsin were compared and associated with tick distribution and vegetation coverage. During 1991-1994, 1,759 confirmed human cases of Lyme disease reported to the Wisconsin Division of Health were assigned a county of residence, but only 329 (19%) could be assigned with certainty a county of exposure. Distributions of cases by county of exposure and residence were often consistent from year to year. Tick distribution in 46 of 72 Wisconsin counties was mapped based on collections by researchers, statewide surveys of infested deer, and submissions from the public. Satellite data were used to calculate a normalized difference vegetation index (NDVI) for each county. A geographic information system (GIS) was used to map distributions of human Lyme disease cases, ticks, and degree of vegetation cover. Human case distribution by county of exposure was significantly correlated with tick distribution; both were positively correlated with high NDVI values in spring and fall, when wooded vegetation could be distinguished from agricultural crops in the satellite image. Statistical analysis of spatial patterns using a measure of spatial autocorrelation indicated that counties with most human cases and ticks were clustered in parts of western Wisconsin. A map delineating the counties with highest risk for Lyme disease transmission was generated based on numbers of exposed human cases and tick concentrations. [Author contact: College of Veterinary Medicine, University of Illinois, Urbana 61801]

Beck LR, Rodriguez MH, Dister SW, Rodriguez AD, Washino RK, Roberts DR, Spanner MA (1997). "Assessment of a remote sensing-based model for predicting malaria transmission risk in villages of Chiapas, Mexico," Am J Trop Med Hyg 1997 Jan;56(1):99-106. Abstract: A blind test of two remote sensing-based models for predicting adult populations of Anopheles albimanus in villages, an indicator of malaria transmission risk, was conducted in southern Chiapas, Mexico. One model was developed using a discriminant analysis approach, while the other was based on regression analysis. The models were developed in 1992 for an area around Tapachula, Chiapas, using Landsat Thematic Mapper (TM) satellite data and geographic information system functions. Using two remotely sensed landscape elements, the discriminant model was able to successfully distinguish between villages with high

and low An. albimanus abundance with an overall accuracy of 90%. To test the predictive capability of the models, multitemporal TM data were used to generate a landscape map of the Huixtla area, northwest of Tapachula, where the models were used to predict risk for 40 villages. The resulting predictions were not disclosed until the end of the test. Independently, An. albimanus abundance data were collected in the 40 randomly selected villages for which the predictions had been made. These data were subsequently used to assess the models' accuracies. The discriminant model accurately predicted 79% of the high-abundance villages and 50% of the low-abundance villages, for an overall accuracy of 70%. The regression model correctly identified seven of the 10 villages with the highest mosquito abundance. This test demonstrated that remote sensing-based models generated for one area can be used successfully in another, comparable area. [Author contact: Johnson Controls World Services, National Aeronautics and Space Administration, Ames Research Center, Moffett Field, California]

Vine MF, Degnan D, Hanchette C (1997). "Geographic information systems: their use in environmental epidemiologic research," Environ Health Perspect Jun;105(6):598-605. Abstract: Advances in geographic information system (GIS) technology, developed by geographers, provide new opportunities for environmental epidemiologists to study associations between environmental exposures and the spatial distribution of disease. A GIS is a powerful computer mapping and analysis technology capable of integrating large quantities of geographic (spatial) data as well as linking geographic with nongeographic data (e.g., demographic information, environmental exposure levels). In this paper we provide an overview of some of the capabilities and limitations of GIS technology; we illustrate, through practical examples, the use of several functions of a GIS including automated address matching, distance functions, buffer analysis, spatial query, and polygon overlay; we discuss methods and limitations of address geocoding, often central to the use of a GIS in environmental epidemiologic research; and we suggest ways to facilitate its use in future studies. Collaborative efforts between epidemiologists, biostatisticians, environmental scientists, GIS specialists, and medical geographers are needed to realize the full potential of GIS technology in environmental health research and may lead to innovative solutions to complex questions. [Author contact: Department of Epidemiology, School of Public Health, University of North Carolina, Chapel Hill 27599-7400]

Pikhart H, Prikazsky V, Bobak M, Kriz B, Celko M, Danova J, Pyrl K, Pretel J (1997), "Association between ambient air concentrations of nitrogen dioxide and respiratory symptoms in children in Prague, Czech Republic: Preliminary results from the Czech part of the SAVIAH Study. Small Area Variation in Air Pollution and Health," Cent Eur J Public Health Jun;5(2):82-85. Abstract: The primary objective of the SAVIAH, a multi-centre study funded by European Union, was to assess new methodology for study of small area health statistics and to implement it in epidemiological health statistics and geography. In Prague, the study has been conducted in two city districts with large variation in air pollution. Data at individual level (health symptoms and socio-economic circumstances of the family) were collected by questionnaires completed by parents of 3680 children aged 7-10 both resident and attending schools within the area (response rate 88%). Aggregated data for geographical areas were available from census and urban planning sources for 692 enumeration districts in the study area which were aggregated into 75 medium sized areas. Outdoor concentrations of nitrogen dioxide (NO2) were monitored by passive samplers. All these data were integrated into a geographic information system (GIS). Spatial distribution of air pollution was estimated by kriging and multiple regression modelling. These models explained about 80% of the variation in air pollution measured by passive samplers. GIS was then used to assign to individuals an exposure based on place of residence and school in order to conduct individual based analyses. Association between NO2 and life-time prevalence of wheezing and/or whistling,

and wheezing/whistling in the last 12 months was studied by logistic regression. For both outcomes, school levels of NO2 were positively related to symptoms but home levels of NO2 showed a negative association. Logistic regression at individual level gives similar results as ecological analysis and multilevel modelling. Hierarchical model yielded somewhat wider confidence limits. Adjustment for parental behavioral and socio-economic factors did not affect these estimates substantially. This study demonstrated the power of the GIS methodology in studying the effects of complex environmental factors on respiratory health of children. [Author contact: Centre of Epidemiology and Microbiology, National Institute of Public Health, Prague, Czech Republic]

Sharma VP, Srivastava A (1997). "Role of geographic information system in malaria control", Indian J Med Res 1997 Aug;106:198-204. Abstract: In this paper we provide an account of our experience in the application of remote sensing (RS) and geographic information system (GIS) in understanding malaria transmission dynamics at the local level. Two studies have been briefly reviewed. One is the application of RS on the mosquito production in the Sanjay lake and surrounding areas in Delhi. Studies are demonstrated that remote sensing data were useful in assessing relative mosquito abundance from large water bodies. The second study was carried out in Nadiad taluka, Kheda district, Gujarat on the application of RS and GIS in a village-wise analysis of receptivity and vulnerability to malaria. For this study, remote sensed data and topo sheets of 1:50,000 and 1:125,000 were used in preparing thematic maps. Digitized overlaid maps were subjected to computer analysis using ARC/INFO 3.1 software. Malaria annual parasite incidence (API) showed relationship with water table followed by soil type, irrigation and water quality, other parameters also contributed to malaria receptivity but less significantly. Based on GIS analysis location specific malaria control strategy was suggested to achieve cost effective control of malaria on a sustainable basis. [Author contact: Malaria Research Centre, (ICMR), Delhi]

VI. Related Census, DHHS and Other Federal Developments

"What We Know So Far... Nutrients, Ground Water, and the Chesapeake Bay - A Link with Pfiesteria?" September 26, 1997 news release from the U.S. Department of the Interior: Scientists from the U.S. Geological Survey (USGS) and other federal and state agencies involved in Chesapeake Bay studies are working together to understand the delivery of nutrients from the land into the Bay and the relationship of nutrients to Pfiesteria-like organisms and ultimately fish health. Scientists suspect a link between high nutrient levels in water and the occurrence of algal blooms and the occurrence of Pfiesteria-like organisms.

Nutrients enter the waters of the Chesapeake Bay from 'point' and 'non-point' sources. Point sources of nutrients (phosphorus and nitrogen)are from wastewater treatment plants or industrial locations. Non-point sources of nutrients are more difficult to identify; they originate from agricultural, urban, suburban, or atmospheric sources. Nutrients enter the Chesapeake Bay from water that is washed off the land surface, chiefly in the aftermath of storms. Nutrients also seep into the ground water from the land surface and make their way into the rivers and streams that flow into the Bay, or directly into the Bay itself.

Ground water is an important source of surface water and nutrients. The USGS has determined that about 50 percent of the water in streams comes from ground water, but the amount can be as low as 27 percent or as high as 85 percent. The amount of ground water varies according to the type of rock and sediment beneath the land surface. Up to one-half of the nitrogen entering the Bay travels through ground water. It is possible that about 10 to 20 percent of the phosphorus entering the Chesapeake Bay also travels through ground water. (A key factor in understanding Chesapeake Bay nutrients is that half of the Bay's water comes from freshwater sources and the other half comes from the ocean.) Travel time of the ground water can be as short as one year or as long as 60 years. The average travel time is between 10 and 20 years. For this reason alone, nutrient levels in the Bay

and any connection with fish health will continue to be a source of concern well into the future. For more information on the Chesapeake Bay and fish lesions, check the following World Wide Web pages on the Internet: http://chesapeake.usgs.gov/chesbay and http://www. usgs.gov.

Net Site(s) of Interest for this Edition: Take a look at Lee De Cola's map animations of urban intensity surfaces between Washington, D.C. and Baltimore, MD, over a 200 year period at http://geog.gmu. edu/gess/classes/ geog590/gis_internet/ldecola/ baltwash. Lee will present his work to CDC/ATSDR on November 19, 1997 as part of the 10th annual celebration of NCHS Geography Awareness Week. His talk is entitled "Giving Statistics a Dynamic Life through Map Animation."

Final Thought(s): A Third Year Anniversary for GIS Users Group and Newsletter!

If you would have told me three years ago that the simple creation of a CDC/ATSDR GIS Users Group would grow from an initial subscribership of 27 interested persons to nearly 600 today, I might have thought there's no way I can keep up with this level of enthusiasm. However, the enthusiasm of this group is what really drives it from my perspective. Not only have we garnered the online interest of more than 300 CDC/ATSDR staff, from across all programs, but we have attracted a large constituency of state and local, academic and even private sector and international public health professionals. And we are continuing to grow.

There is satisfaction in knowing that our GIS users group, and the bimonthly reporting instrument "Public Health GIS News and Information," now routinely promotes GIS and public health discussion among us. We are a rich blend of occupations and work settings. I thank each of you for your participation and your willingness to share news about GIS activities, technical and research concerns and, of course, your enthusiasm. Two current developments are in the making as we look towards the coming year. The first is that we plan to establish a Listserver for the group due to our growing membership. This should eliminate mailhandling constraints on system servers that cannot accommodate large frontend e-mail address listings. Even where these addresses can be handled, the Listserver will alleviate the need to have to scroll through and delete extensive unwrapped addresses.

The second item I want to share is probably more exciting. There is going to be a national "GIS in Public Health" conference in 1998. The Agency for Toxic Substances and Disease Registry (ATSDR), and a variety of institutional cosponsors, will host the conference sometime in late August in San Diego. The tentative plan is to have a three-day conference with the possibility of optional pre-conference and post-conference workshops. Confirmation of conference dates and designation of host hotel is still pending at the moment. However, I would like to introduce the Advisory and Steering Committee members who have been diligently at work for many months and deserve your recognition: Advisory Committee members include Barry Johnson, Assistant Administrator (ATSDR), Bob Williams (ATSDR) and Karl Longley (Cal State Fresno); Steering Committee members include Fred Broome (US Bureau of the Census), Cheryl Connelly (National Association of County and City Health Officials), Charles Croner (NCHS, CDC), Candy Davis (ATSDR), Steve Guptill (US Geological Survey), Bill Henriques, Advisory Committee Chair (ATSDR), Monty Howie (ATSDR), Eric Juzenas (American

Public Health Association), Chet Moore (NCID, CDC), Sue Perlin (US Environmental Protection Agency) and Jon Sperling (US Bureau of the Census).

On behalf of all, I want to encourage your attendance and possible participation in the "GIS in Public Health" conference. The committee is constructing a program that will incorporate many of your suggestions and address many of your stated needs. The emphasis throughout the conference will be instructional and informative. There will be topical tracks to address new and seasoned GIS users. Please plan ahead to be there for this special occasion. I again thank each of you for the success we have enjoyed as we close three rewarding years of CDC/ATSDR GIS User Group communication. Editor

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Celebrating three continuous years of GIS and Public Health communication!